INTRA-FRAME INTERPOLATION BASED LINE-BY-LINE TUNING FOR ELECTRONIC DISPLAYS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Patent Application No. 62/906,552, entitled "Intra-Frame Interpolation Based Line-by-Line Tuning for Electronic Displays," filed on Sep. 26, 2019, which is incorporated by reference herein in its entirety for all purposes.

SUMMARY

[0002] A summary of certain embodiments disclosed herein is set forth below. It should be understood that these aspects are presented merely to provide the reader with a brief summary of these certain embodiments and that these aspects are not intended to limit the scope of this disclosure. Indeed, this disclosure may encompass a variety of aspects that may not be set forth below.

[0003] The present disclosure generally relates to providing line-specific common voltages (Vcoms), which may reduce or eliminate the occurrence of visual artifacts, such as screen flicker. Visual artifacts may reduce the clarity or perceived image quality of the information presented to a person by an electronic display. In some cases, visual artifacts may occur due to a common Vcom voltage being applied to the pixels of an electronic display. For instance, different portions of the electronic display may have different properties, meaning different Vcoms may be more likely to reduce image artifacts that might otherwise appear in different portions of the electronic display.

[0004] As described below, different Vcom values associated with different regions of a display may be determined that are likely to reduce image artifacts that might otherwise appear. Different Vcom values for groups of the regions (e.g., rows of regions) may also be determined that are likely to reduce image artifacts that might otherwise appear. These different (e.g, optimal) Vcom values for lines of pixels throughout the display may be determined by interpolating a curve (e.g., a flicker curve) associated with the regions, and these Vcoms may be provided to the pixels of the display. As such, a Vcom that is tailored for each particular line of pixels in an electronic display may be provided, which may reduce and/or eliminate the occurrence of flickering that is perceivable to the human eye.

[0005] Various refinements of the features noted above may be made in relation to various aspects of the present disclosure. Further features may also be incorporated in these various aspects as well. These refinements and additional features may exist individually or in any combination. For instance, various features discussed below in relation to one or more of the illustrated embodiments may be incorporated into any of the above-described aspects of the present disclosure alone or in any combination. The brief summary presented above is intended only to familiarize the reader with certain aspects and contexts of embodiments of the present disclosure without limitation to the claimed subject matter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] Various aspects of this disclosure may be better understood upon reading the following detailed description and upon reference to the drawings in which:

[0007] FIG. **1** is a schematic block diagram of an electronic device, in accordance with an embodiment;

[0008] FIG. **2** is a perspective view of a notebook computer representing an embodiment of the electronic device of FIG. **1**;

[0009] FIG. **3** is a front view of a hand-held device representing another embodiment of the electronic device of FIG. **1**;

[0010] FIG. **4** is a front view of another hand-held device representing another embodiment of the electronic device of FIG. **1**;

[0011] FIG. **5** is a front view of a desktop computer representing another embodiment of the electronic device of FIG. **1**;

[0012] FIG. **6** is a front view and side view of a wearable electronic device representing another embodiment of the electronic device of FIG. **1**;

[0013] FIG. **7** is a block diagram of the electronic display of FIG. **1**, in accordance with an embodiment;

[0014] FIG. **8** is a block diagram of the electronic display and the intra-frame interpolation integrated circuit of FIG. **7**, in accordance with an embodiment;

[0015] FIG. **9** illustrates a Vcom calibration that may be used to determine and program line-specific Vcoms onto lines of pixels of an electronic display, in accordance with an embodiment;

[0016] FIG. **10** is process for calibrating the Vcom for lines of pixels of an electronic display, in accordance with an embodiment;

[0017] FIG. **11** is a graph of a VCOM curve for reducing (e.g., minimizing) flickering as well as segments associated with intra-frame interpolation, in accordance with an embodiment; and

[0018] FIG. **12** is an example of timing diagram associated with performing intra-frame interpolation, in accordance with an embodiment.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0019] One or more specific embodiments will be described below. In an effort to provide a concise description of these embodiments, not all features of an actual implementation are described in the specification. It should be appreciated that in the development of any such actual implementation, as in any engineering or design project, numerous implementation-specific decisions must be made to achieve the developers' specific goals, such as compliance with system-related and business-related constraints, which may vary from one implementation to another. Moreover, it should be appreciated that such a development effort might be complex and time consuming, but would nevertheless be a routine undertaking of design, fabrication, and manufacture for those of ordinary skill having the benefit of this disclosure.

[0020] When introducing elements of various embodiments of the present disclosure, the articles "a," "an," and "the" are intended to mean that there are one or more of the elements. The terms "comprising," "including," and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements. Additionally, it should be understood that references to "one embodiment" or "an embodiment" of the present disclosure are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited